A change of course

How to build a fair future in a **1.5°** world

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How to build a fair future in a 1.5° world
is jointly published by:

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www.ideainaforest.org
Editorial Responsibility (V.i.S.d.P.):
Yvonne Weber, BUND
Printed by: **ARNOLD Group**, Großbeeren, Germany

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How to build a fair future in a **1.5°** world

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Berlin 2017

At the tipping point

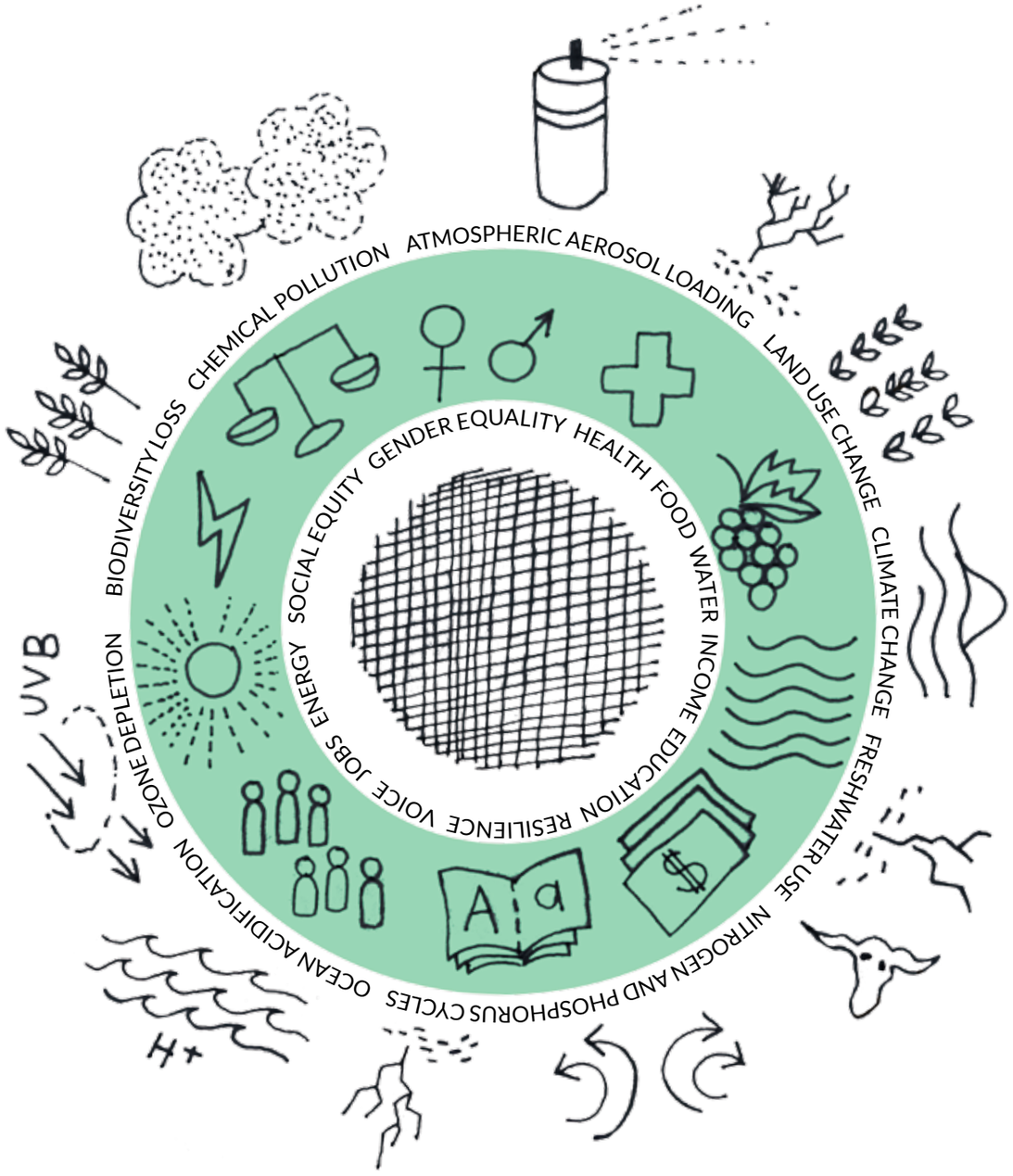
The climate crisis is posing an old question with increasing urgency: What kind of world do we want? One that respects the basic needs and desires of all people for a good life in a healthy environment? One in which fair rules ensure social justice and prevent individual interests from becoming detrimental to the common good? One in which democratic involvement and social participation are possible? And one that offers all this to our children and their descendants on every continent?

Instead of coming closer to this type of world, we are constantly moving further away from it. People drown in floods triggered by extreme rainfall. Typhoons destroy their homes. Droughts force hundreds of thousands to abandon their parched fields for urban slums, and millions will lose their homes to rising sea levels. All these things are happening now and their frequency will increase dramatically (***p. 4/5***) if we do not address climate change before its momentum becomes unstoppable.

Is it utopian to push for a good life for all in the face of the climate crisis? Perhaps. Yet it is no less realistic than the utopia of infinite growth on a finite planet. Numerous practical examples show how we can realize a sustainable and habitable world for all – from decentralized renewable energy generation to proven concepts for sustainable forest management (***p. 21***), ideas for modern mobility (***p. 15***) and ecologically sound food production (***p. 19***). The one thing they have in common is that they show us how we can live a good life, work and do business – within the planet's limits. And how we can do so without trampling human rights and democracy and subjecting millions to marginalization and lives of poverty.

The urgency with which we need to address social, environmental and democratic issues alike becomes terribly clear when we take stock of our current situation: Since 1970, the lifestyle and consumption habits of the global middle class have led to the extinction of half of all vertebrate species. A quarter of all global soils are degraded. Unprecedented coral bleaching is taking place in the increasingly acidic oceans. More than one billion people lack access to clean water. The gap between the rich and poor has widened to the point that the 8 richest men have now amassed as much wealth as the 3.7 billion of the poorer half of humanity combined. Of the 17 warmest years on record since 1881, 16 have been in the new millennium. Worldwide, the number of weather-related natural disasters has increased. Between 1970 and 2012, nearly two million people lost their lives as a result.

Can the climate crisis be stopped by even more markets – albeit "green" ones and those for greenhouse gas emissions? Can economies and political systems that are geared toward growth deliver effective answers for setting absolute limits on resource and energy consumption? Can we still afford to put all of our hopes into technological solutions to resolve the numerous social and environmental crises of our time in one fell swoop? (***p. 8***)



Graphic inspired by Kate Raworth's doughnut of social and planetary boundaries. See http://www.kateraworth.com/doughnut/

From 2 degrees to 1.5 degrees: no half-measures

Cheers broke out in the Le Bourget conference center on the evening of December 12, 2015, when French Foreign Minister Laurent Fabius brought down the gavel and declared the Paris Agreement to have been adopted. Climate diplomats and senior negotiators who normally maintain a polite distance fell into each other's arms. Policymakers and heads of state who otherwise keep a tight rein on their emotions shed tears of joy. Years of preparations, two weeks of stressful summitry and a nail-biting finale lay behind the negotiators.

It was time for grand words: The Paris Agreement that conference president Fabius concluded with his gavel was an "historical breakthrough," a "turning point," a "peaceful revolution" and "a victory for all of the planet and for future generations." Indeed, the agreement far exceeded even the expectations of optimists. Humanity now declares that it will not permit warming to exceed 2°C. The new limit is "well below" 2°C – ideally only 1.5°C. The world is supposed to be "climate neutral" by the second half of the century.

The Paris Agreement – an unequivocal call to action

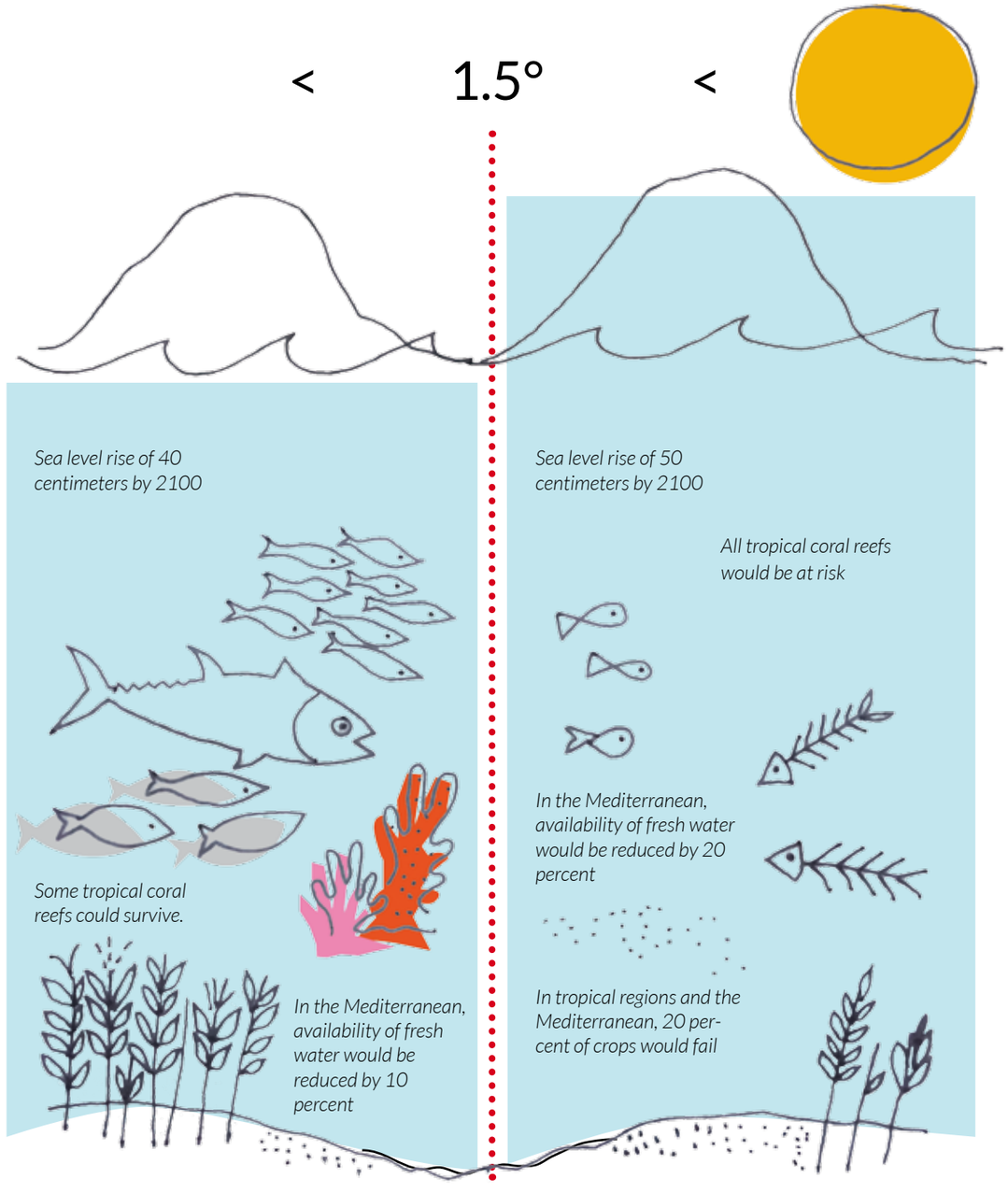
The new 1.5°C limit is an unequivocal call to action: More needs to be done at once to reduce the emission of greenhouse gases, as all 196 member states of the UN Framework Convention on Climate Change (UNFCCC) have recognized. Small island states and other countries that are particularly vulnerable to climate change will no longer be fobbed off with fine words and a shrug.

Strictly speaking, however, the international community is only following through on its own promises. For more than 20 years, the UNFCCC has been clear and straightforward about what a climate agreement should achieve: food and water security, as well as the prevention of ecosystem disruptions that could jeopardize these two goals.

Studies have shown with increasing clarity that this cannot be achieved with a 2°C limit. With an increase of this magnitude, no one would seriously be able to guarantee universal access to even the most basic human needs – food and water – any longer. Should it be possible to limit global warming to 1.5°C, the risks would decrease considerably, however.

In tropical regions – or even the Mediterranean – crop failures for key staple foods would then amount to "only" 10 percent, instead of at least 20 percent. The prolongation of heat waves will be less pronounced. Sea level rise would be reduced by an estimated 10 centimeters. Marine researchers have long warned that the oceans would not be able to handle more than 1.5°C of warming. The oceans absorb most of the sun's energy, as well as 24 million tons of CO_2 – every day. Acidification is disturbing the balance of marine ecosystems and is a further existential threat to overexploited global fish stocks. Security experts and military strategists are also warning against unchecked climate change. Droughts, crop failures and water shortages exacerbate the potential for conflict in many regions of the world. For the climate, 1.5 versus 2.0°C does indeed make a world of difference.

A major political goal is more easy to proclaim than bring to life, however. Based on the national climate plans that have been submitted to the UN by the signatories of the new agreement, the world is still heading for 3.0°C of warming.

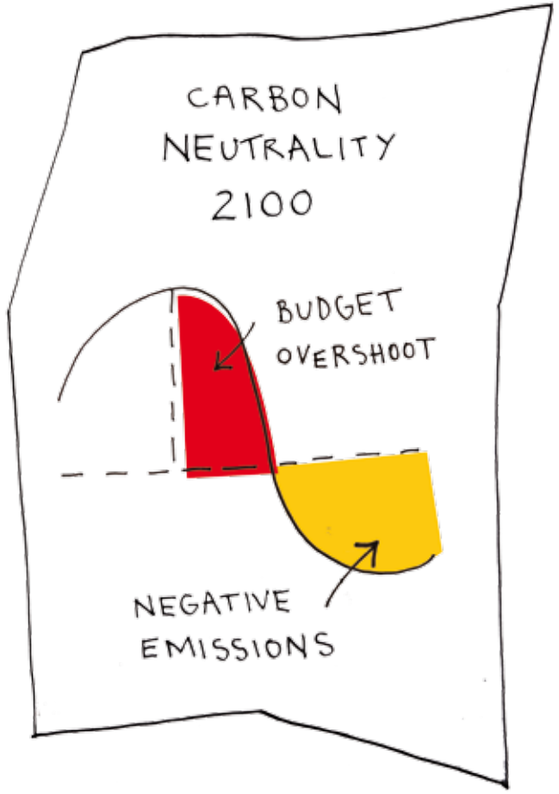


The overdraft mentality

It was a desperate attempt to make policymakers aware of the urgency of climate protection. Climate scientists figured that if there is one thing politicians can do, it is juggling budgets – and thus they introduced carbon budgets in 2009. The underlying idea was to calculate the maximum amount of greenhouse gases that humanity can still emit. As of July 2017, the limit needed to ensure a 60 percent chance of keeping global warming below 1.5°C was 154 billion tons of carbon. If all currently planned coal-fired power plants (***p. 17***) are actually built and operated over their normal service life of 40 years, they alone would emit around 300 billion tons of CO_2.

There is a catch to the logic of budgets, however: The budgets that policymakers normally work with can be exceeded from time to time, and they therefore expect the atmosphere to grant us an overdraft as well. The world is under tremendous pressure to pursue this idea, as we will have exhausted the CO_2 budget dictated by the 1.5°C limit by the year 2021 if we keep emitting at our present rate.

The current proposal is to rely on risky technologies to pay back that overdraft in the distant future. One such idea would be to grow biomass on a grand scale and burn it, while capturing the millions of tons of CO_2 thus released and storing it underground. To date, however, this "bioenergy with carbon capture and storage" (BECCS) technology only works on paper; it would also entail devastating ecological and social consequences (***p. 10***). All ideas for negative emissions technologies have a critical flaw: The perspective of an "atmospheric overdraft" reduces the pressure to dramatically reduce carbon emissions in the here and now. An idea that could at best serve as Plan B is thus well on its way to upstage Plan A – a fundamentally different economy that would keep the planet habitable for all.

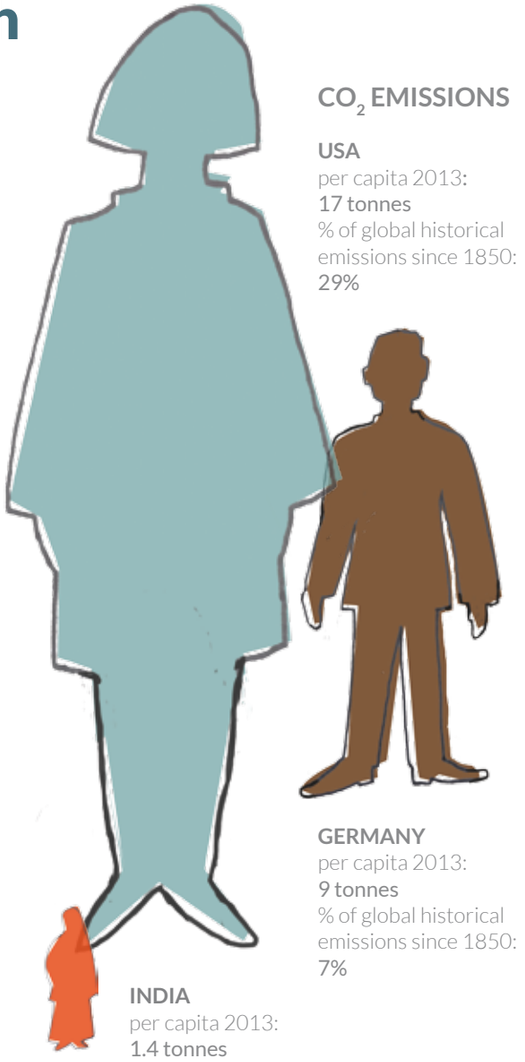


Fair play – not just on the football pitch

The countries of the Global North are largely responsible for climate change with their fossil-fueled development and their growing predilection for sports cars, air travel, steaks and power-hungry electronics. However, the consequences of this development – which on a positive note boosted millions of people into the middle class – are being felt especially strongly by the Global South, which has far fewer financial and technical resources to adapt to increasing droughts, storms and floods.

The Paris Agreement (***p. 4***) only reflects this to a limited degree. Each state is free to define how aggressively it wants to reduce emissions. This is unjust, however: A country's fair share of the global climate protection burden depends on its past emissions and its financial resources. Seen in this light, the climate targets reported by many developing countries are actually stronger than those of the industrialized countries.

Individual countries should not be allowed to decide for themselves what constitutes equitable climate protection – climate justice must be the fundamental principle of climate policy and the benchmark for the initial evaluation of national climate plans of all countries in 2018. This includes requiring greater contributions toward climate protection from historically responsible countries, as well as ensuring that they support poor countries adequately. Those who do not act, reinforce the injustice. The international community must push for climate justice in implementing the plans. Furthermore, climate protection measures must be ecologically sound and socially just while being compatible with fundamental democratic principles.



We are on the wrong track

More than one billion cars currently exist on our planet, and tens of millions of new ones are produced every year. Global meat production has quadrupled in the past 50 years and continues to rise. The volume of international air traffic is growing rapidly. And even after the signing of the Paris Agreement, more than 1,400 gigawatts (GW) of new coal plant capacity is under construction – or planned – worldwide, and many corporations have been granted new oil-drilling permits. Although the expansion of the renewable energy sector is proceeding, and the global appetite for energy is growing more slowly than before, it is still growing nonetheless, even though it needs to decrease dramatically. A radical turnaround is needed in dealing with the climate crisis, and yet, wherever you look, it is business as usual. The feel-good rhetoric of the "green economy" that promises steady growth with increasingly intelligent green technologies is not helping. The reliance on emissions trading (***p. 16***) and offsetting (***p. 14***) is an attempt to make climate protection and ecosystem conservation comply with the market economy. And an increasing number of hands are grasping at the straws of negative emissions technologies (***p. 10***), as the remaining emissions budget melts away rapidly under business-as-usual conditions (***p. 6***).

In this case, the technocratic paradigm – the one-dimensional belief that technology and economic activity can solve all problems – is part of the problem: It does not know how to address the fact that we have millions of more fuel-efficient cars and drive billions of additional kilometers in them. It ignores the influence of powerful lobbies that benefit greatly from perpetuating business-as-usual. Our faith in technology is encouraging us to make the highly risky wager that we can fix the world's climate system by using BECCS (***p. 10***). Furthermore, CO_2 cannot serve as a suitable universal currency for sustainable action, as it establishes a global zero-sum game in which the Global North can buy its way out of its responsibility to take action, while weighing the rights of indigenous peoples against tonnages of CO_2.

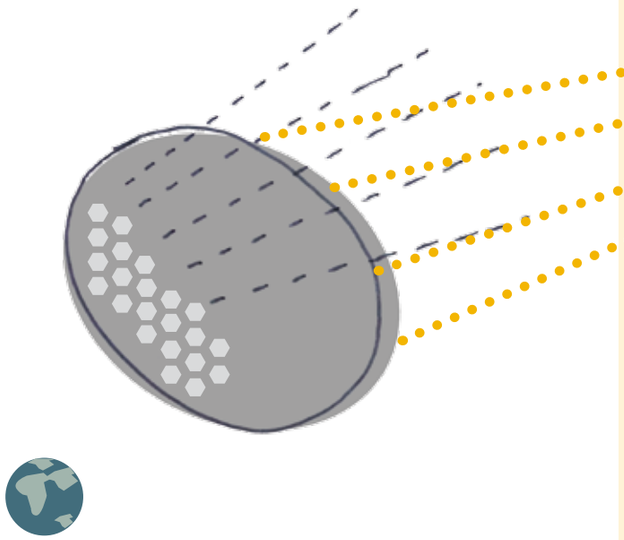
The way to go

The good ideas – as opposed to offsetting, emissions trading and negative emissions technologies – are anything but new: The surest way to slow the climate catastrophe is to begin the fastest possible exit from coal, oil and gas. Sound policy could help us advance swiftly to the day where solar power, wind and other renewable sources provide 100 percent of the energy we need to heat our homes, run our machines and move us from Point A to B. Bicycle-friendly cities with efficient public transportation systems testify to the quality of life our residential environments could offer with a fundamental change in transportation policy. The small farms worldwide that deliver 70 percent of all food products with only 30 percent of agricultural resources prove that the planet can feed us without the massive use of fertilizers and pesticides. Forest conservation is successful wherever corruption is combatted effectively, and local people can reach a consensus on forest use. Change becomes possible wherever the lobbyists of fossil fuel corporations, agricultural giants and the automotive industry no longer have access to politicians and decision-makers. We are on the right track whenever we recognize that the goal is not just the ever-more-efficient production of the same quantities, but greater sufficiency – that is, less production and consumption.

These are the feasible concepts that we must advance significantly over the next five to ten years – not as a global master plan, but in numerous regionally adapted varieties. They make climate protection a reliable goal without negatively impacting ecosystems, social issues and democratic participation.

A key element in all of this is the question: Will we succeed quickly enough? Will we drastically curb the burning of fossil fuels and ban internal combustion engines from the roads in the very near future? Will we manage a sufficiently fundamental transformation of industrial agriculture and stop the rampant exploitation of our forests? The alternatives are available. We need to implement them – swiftly and globally.

Geoengineering – treating symptoms and causing side effects

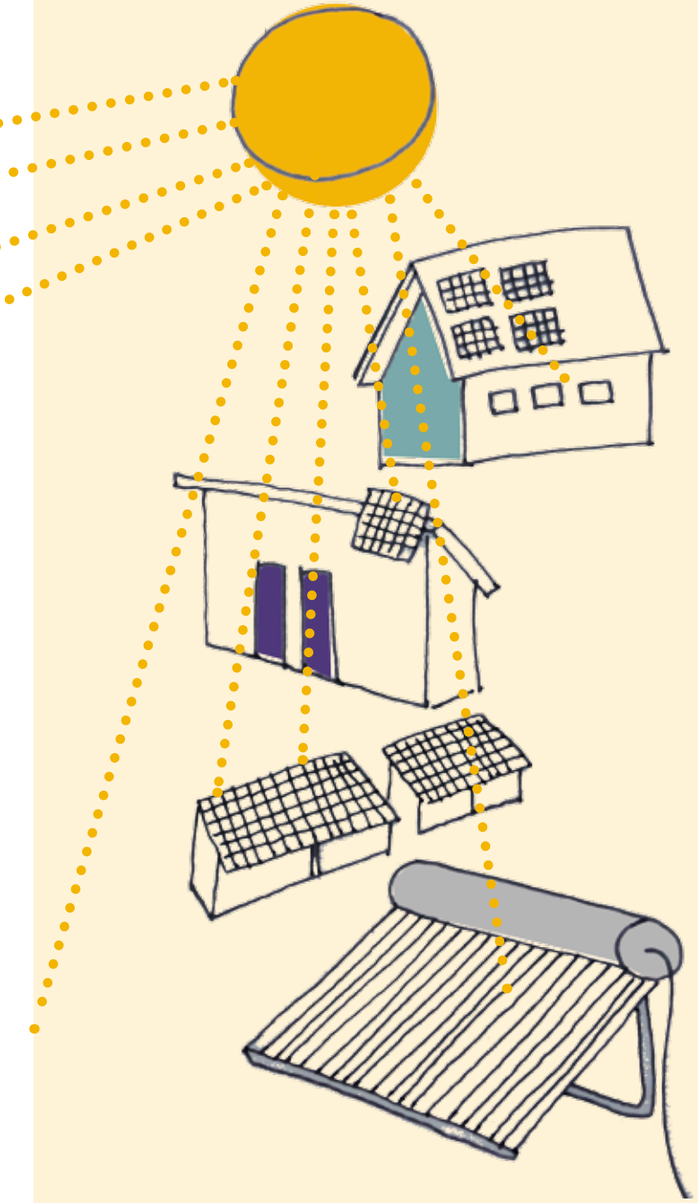


Idea: So much CO_2, methane and other gases are being pumped into the atmosphere and oceans that the Earth is being transformed into an ever-hotter greenhouse. The more evident humans' reluctance to radically cut their emissions becomes, the greater the temptation for some to fix the problem with technological interventions. In the logic of the technocratic paradigm, this would be just another technological wonder devised by the engineering mind – like rockets flying to the moon, supersonic aircraft and refrigerators that take care of the shopping. The idea of actively controlling the climate is known as "geoengineering." Broadly speaking, there are two approaches. **Solar radiation management** would use giant mirrors in orbit or inject sulfate aerosols into the atmosphere to simulate the effect of a volcanic eruption. **Carbon dioxide removal** (CDR) aims to remove greenhouse gases from the atmosphere through CCS or bioenergy CCS, or by fertilizing the oceans with iron to stimulate the growth of phytoplankton to absorb more CO_2. Urea could also be used as an alternative to iron.

Climate effects: Technologies such as sulfate aerosol injection could essentially "freeze" global warming – but with huge, virtually unpredictable regional differences. Some countries would benefit from the intervention, whereas others would experience more heat and droughts. Overall, worldwide rainfall patterns would change strongly and often decrease – bad news for global food security.

Ecological impact: Already in 2010, the member states of the UN Convention on Biological Diversity agreed on a moratorium. The reason: Geoengineering cannot be reconciled with the conservation of ecosystems.

Social impact: Geoengineering would dramatically change the face of the planet – and thus raise the question of who has the authority to make such far-reaching decisions with largely unknown outcomes for the entire world population. This also holds true for technologies such as bioenergy CCS (*p. 10*). To remove enough CO_2 from the atmosphere, a large share of the world's arable land would have to be dedicated to this purpose. No one can say how it would then be possible to feed a projected population of nine billion in 2050.



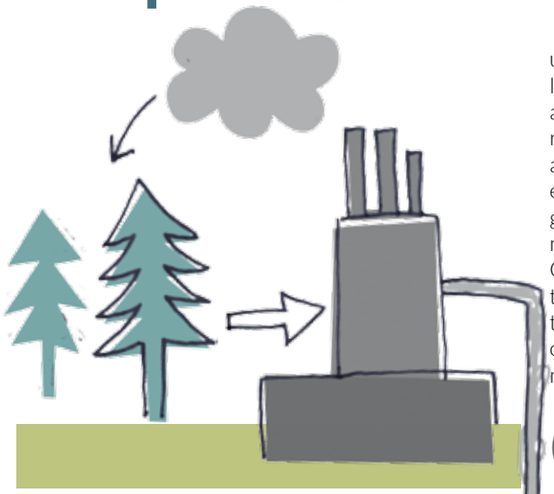
Radical emission reductions!

Instead of relying on risky large-scale technologies and their hardly foreseeable consequences, the climate problem could simply be dealt with at the root – by drastically reducing emissions of greenhouse gases. The burning of fossil fuels causes two-thirds of global emissions, so it is crucial that we phase out coal, oil and gas completely. The multibillion-dollar subsidies that are still fattening the fossil-fuel companies could then be dispensed with – and the funds could instead go toward education, health care, social security systems or providing a social safety net for those impacted by the transformation of energy systems. If countries such as Saudi Arabia, Russia and the United States were to scale back their huge subsidies, this would already lead to a reduction of their emissions by more than 10 percent over the next four to five years.

Renewable energies are taking the place of fossil fuels. Their expansion must be accelerated and promoted using laws such as Germany's Renewable Energy Act (EEG). Technically, it is already feasible to supply many industrialized countries with 100 percent renewable energy – at least with regard to electricity. For total energy – including heating and transportation – the year 2050 would be realistic. In terms of global investment in new electricity generation, renewables have already outstripped fossil fuels.

However, around 1,000 new coal plants are still under construction or on the drawing board. If they were to become operational, they alone would account for more CO_2 emissions than the carbon budget would allow for under the 1.5°C limit. The number of plans for new plants is at least now declining. In 2016, the generating capacity currently in the pipeline for the number-one climate killer dropped from 1,090 to 570 GW. Perhaps the Paris climate summit is already having an effect.

BECCS – a mirage with bold promises



use biomass as a "carbon-neutral" source of energy. Its large-scale cultivation and transport already consumes a lot of energy, while industrial agricultural methods result in the release of CO_2 from the soil (***p. 18***). In addition, the process itself requires a great deal of energy. And whether the CO_2 will actually remain in the ground for good is more than uncertain. Nevertheless, most scenarios used in the Intergovernmental Panel on Climate Change (IPCC) that limit global warming to less than 2°C rely on the "negative emissions" that BECCS technology will supposedly provide. Sp far mainstream climate science does not offer any paths that would meet the 1.5°C limit without BECCS.

Idea: By themselves, neither the large-scale and problematic use of bioenergy, nor the controversial carbon capture and storage (CCS) technology work. However, the combination of both methods gives rise to one of the seemingly most promising current technologies: BECCS is intended to remove CO_2 from the atmosphere, thus giving us greater leeway in our remaining budget for dealing with climate-damaging carbon emissions (***p. 6***). The technology involves burning biomass in power plants, capturing the emitted CO_2 and storing it underground. So far, BECCS only exists on paper. It remains to be seen whether the technology will ever be ready for use on a large scale. So far, it has only been used on a small scale in the fermentation of biomass to ethanol.

Climate effects: Although untested, expectations of the technology are immense. The cultivation of biomass, however, also has a climate impact: It is virtually impossible to

Ecological impact: Keeping global warming below 2°C with BECCS would require about 500 million hectares of land – one and a half times the area of India. The vast monocultures using massive quantities of pesticides and fertilizers would reduce biodiversity further while contaminating groundwater and degrading the soil. An additional danger is that escaping CO_2 could lead to an acidification of the ground water.

Social impact: Farmland that people rely on for their livelihoods and ecosystems worthy of protection would be sacrificed for the gigantic BECCS plantations. Land conflicts would ensue. The consequences of today's land-grabbing illustrate how this would impoverish people, stoke violence and destroy communities.

It's all in the soil!

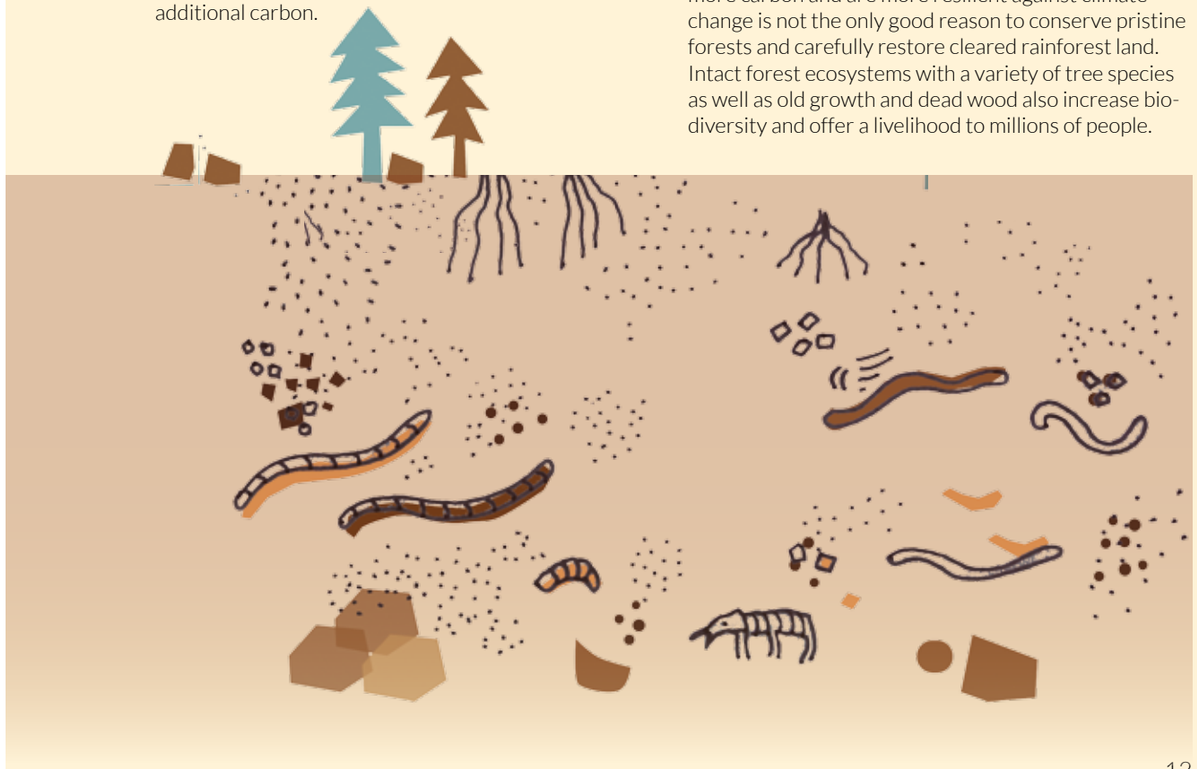
Proven and rediscovered cultivation methods are a sound alternative to relying on the latest technologies with uncertain outcomes and high risks. Organic farming (***p. 19***), with longer and more diverse crop rotations, helps build organic matter to nourish the natural microorganisms in the soil and improve soil quality. This reduces emissions from agriculture, as the organic carbon stored in soils is the planet's second-largest carbon reservoir after the oceans. Human activity – the selection of plants, the type of fertilization and the methods by which the soil is tilled – directly influences how much carbon is bound or released. Studies show that with the correct cultivation methods, soils can even store additional carbon.

Living wetlands

In recent decades, numerous wetlands have been drained to obtain additional arable land for agriculture. A great deal of CO_2 is released in the process. Restoring wetlands causes the emissions to fall again – and the unique habitats can help ensure the survival of endangered plant and animal species.

Vital forests

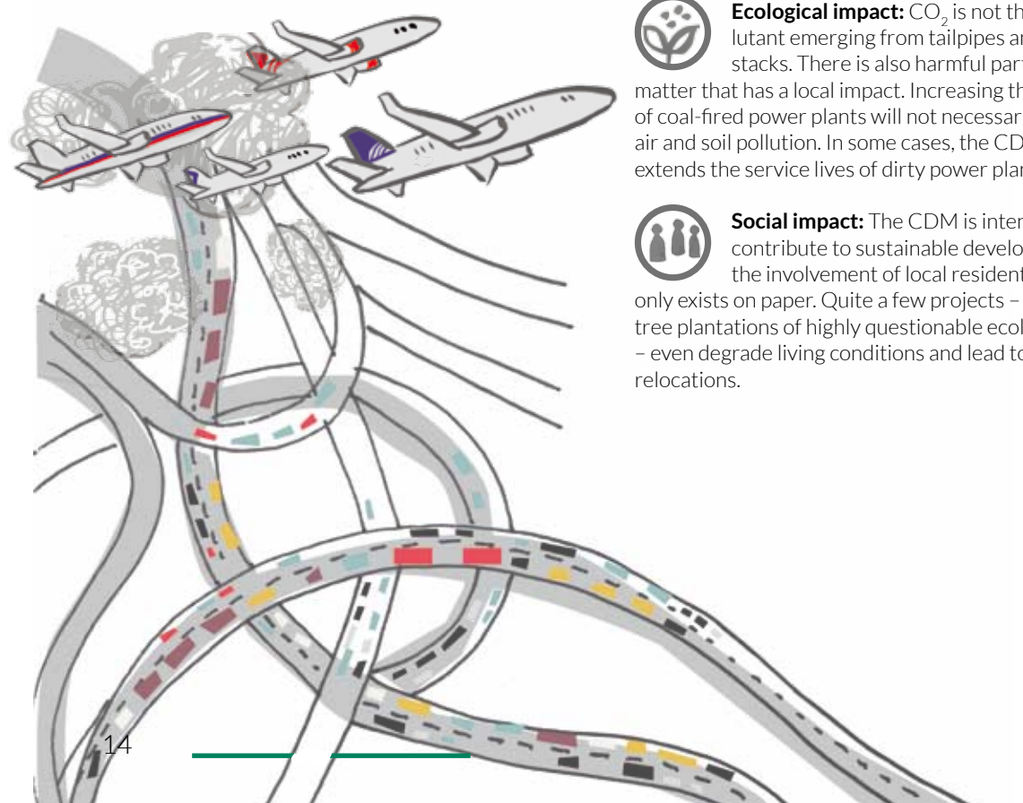
The fact that intact forests (*p. 20*) store considerably more carbon and are more resilient against climate change is not the only good reason to conserve pristine forests and carefully restore cleared rainforest land. Intact forest ecosystems with a variety of tree species as well as old growth and dead wood also increase biodiversity and offer a livelihood to millions of people.



Carbon offsetting: the zero-sum game

Idea: In principle, it does not matter for the planet's climate where greenhouse gases are emitted or reduced. Following this logic, the 1997 Kyoto Protocol stipulated that industrialized countries do not necessarily need to fulfill all of their climate protection obligations "at home" – they can also finance less costly projects in developing countries via the Clean Development Mechanism (CDM).

At the same time, a huge market has sprung up in which companies or private individuals can offset their flights, bus trips or events voluntarily. The providers' projects vary in quality, and while there are many black sheep in the industry, numerous effective projects are financed by voluntary offsets.



Climate effects: Carbon offsetting is not about preventing CO_2 emissions. Offsetting emissions does nothing to change the root of the problem – for example the climate impact of (air) traffic.

In addition, it is often difficult to document that a climate protection project has resulted in additional savings of CO_2, and if so, to what extent. Forestry projects are not at all effective in this respect: When coal is burned, carbon that was previously safely and permanently stored underground is released. By contrast, tree plantations only store it for a short time – until the next forest fire or drought.

Ecological impact: CO_2 is not the only pollutant emerging from tailpipes and smokestacks. There is also harmful particulate matter that has a local impact. Increasing the efficiency of coal-fired power plants will not necessarily reduce air and soil pollution. In some cases, the CDM even extends the service lives of dirty power plants.

Social impact: The CDM is intended to contribute to sustainable development. Yet the involvement of local residents often only exists on paper. Quite a few projects – such as tree plantations of highly questionable ecological value – even degrade living conditions and lead to forced relocations.

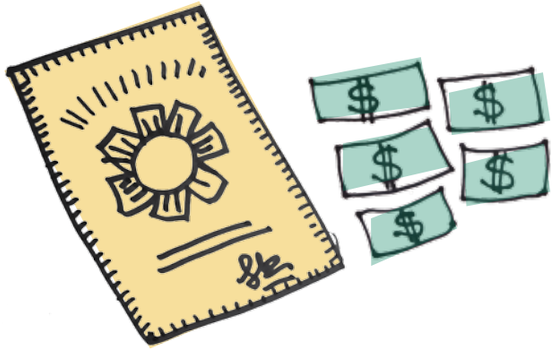
A course change instead of creative accounting

It is time to set aside the calculators and abacuses and simply get started with the transformation! In many cases, the course of action has long been known. Take the transportation sector: The dream of owning a car – and the freedom and independence it promises to each and every person – has been obsolete for some time. What is needed is a new transportation system focused mainly on rail transportation, phasing out the internal combustion engine and avoiding traffic. Buses could be deployed in areas where the expansion of railways is not feasible – in rural areas or megacities, for example. Car sharing or bicycles are suitable options for covering the last mile from the last stop to the final destination. Transportation systems must mesh tightly to ensure convenience and flexibility for users.

"Dieselgate" has shown that we cannot rely on the automotive industry to be even remotely as interested in the climate as in its sales figures. Policymakers must radically change course and make climate-friendly transportation attractive. Available measures include strengthening public transportation, encouraging the use of railways for freight traffic, building bike paths and subsidizing delivery bicycles. Intelligent action could reduce transportation-related emissions in Germany, for example, by 95 percent by 2050.

A transportation revolution need not fail due to lack of funding. In Germany, for example, it could be financed through levies on climate-damaging fuels, taxing company cars and raising the vehicle tax. In other countries, phasing out fossil fuel subsidies can free up public funds. India is already taxing luxury cars and SUVs. A transportation revolution is urgently needed – for the climate, and to ensure that long-suffering city dwellers can finally breathe easily.

A license to pollute



Idea: Gently motivating business to protect the climate without harming the economy: That was the idea behind the introduction of the EU Emissions Trading Scheme in 2005. To ensure that emissions-intensive industries such as coal-fired power plants or aluminum smelters do not have to shut down overnight, emissions are subject to gradually decreasing legal caps. The technological transformation is thus supposed to be realized in a "market-based and cost-effective" manner. Large parts of industry are allocated mostly free allowances based on tons of CO_2 equivalent. Trading in allowances is intended to promote climate protection where it is most cost-effective. More than 15 countries and regions have introduced emissions trading, including California, New Zealand, Japan and seven Chinese provinces.

Climate effects: The incentive effect of European emissions trading is marginal due to the drop in prices – CO_2 allowances that once traded for €30 have declined to junk status, with prices in the single digits. A high CO_2 price was intended to make coal power and aluminum production more costly in order to promote climate-friendly technologies. Yet, the opposite happened: A glut of generation capacity has caused the market price of electricity to drop. Coal is cheap, and so gas plants are shut down first. This is a declaration of bankruptcy for climate protection and a terrible development for the electricity market, which relies on highly flexible gas plants to complement the increasing share of renewables. Despite its lack of incentive effect, emissions trading is set to remain the EU's central climate protection instrument after 2020. As a consequence of the Paris Agreement, climate protection certificates ("mitigation outcomes") could soon be traded globally – opening a whole new dimension of worldwide offsetting. (*p. 14*)

Ecological impact: Emissions trading in the EU currently covers around 45 percent of European emissions. Although intra-European air traffic was included in 2012, major sectors such as agriculture and road traffic have still not been taken into account. Energy-intensive materials such as aluminum are still inexpensive and are being mass-produced despite the high energy consumption this entails. At the same time, airports are being expanded throughout Europe – to the detriment of the local populations and ecosystems.

Social impact: Instead of raising the price of fossil fuels and making polluters pay, the opposite has happened: Many large companies have made good money in emissions trading. Businesses have made more than €24 billion in profits with the trading system. German industry alone pocketed €4.5 billion. The alleged costs of trading were often directly passed on to end-customers and consumers.

Coal phase-out legislation with a clear time frame

How can we ensure that the most damaging fuel for the climate – coal – is not still being burned on a grand scale 10, 20 or 30 years from now? Coal is responsible for more than a quarter of total annual greenhouse gas emissions. Coal mining displaces people, contaminates water and pollutes the air breathed by millions of people the world over with particulate matter and mercury. Instead of hoping that a poorly controllable market in allowances will make coal power and heat expensive and unattractive in time, we need a legal framework to enforce the fastest possible coal phase-out. Industrialized countries – above all Germany, as the world's largest lignite mining country – must lead the way.

For countries where coal is mined or burned, this means that certainty is needed about when individual coal power plants will be taken off the grid and coal mines closed forever. This could be realized by legislation setting maximum operating periods for existing power plants that would be compatible with the 1.5°C limit. Or it could establish minimum efficiency levels that would force the closure of old power plants in the coming years, or establish emissions ceilings for individual power plants. An immediate moratorium on all new coal mines would be a useful measure. In Germany, the end of coal power by 2030 must be regulated by law.

To have a realistic chance of staying within the 1.5°C limit, phasing out coal must be at the top of the list of the most urgent climate protection measures. It would eliminate one-quarter of all global greenhouse gas emissions in a very short time. With concepts for a just transition and democratically developed ideas for the structural change, we can ensure that this does not work to the detriment of the weakest.

Climate-smart agriculture: the hijacked idea

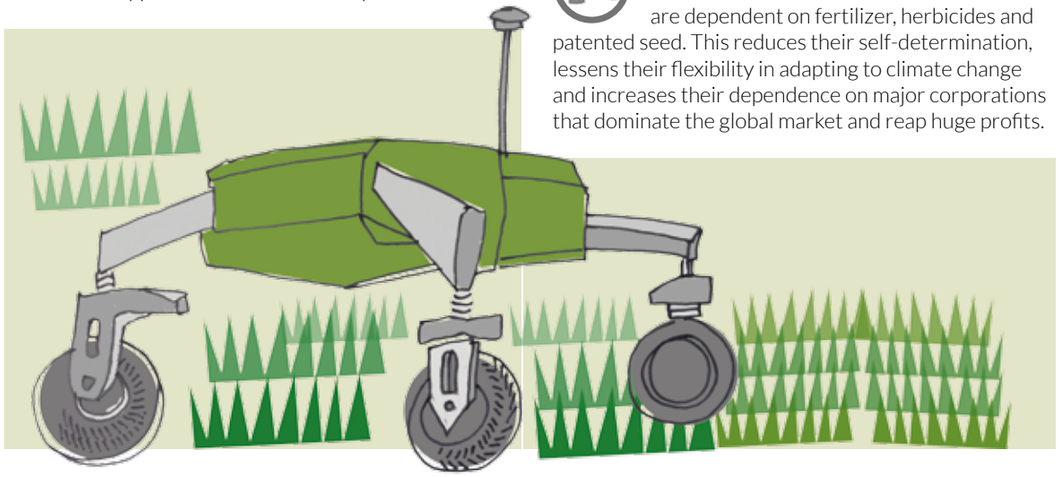
Idea: For years, a number of industrialized nations and biotech corporations have been pushing to include agriculture in emissions trading (*p. 16*). By purchasing CO_2 allowances, companies would be able to keep their calculated net emissions low, as many soils have significant carbon storage potential. The IPCC estimates the worldwide carbon-sink potential of soils to be around 6 billion tons of CO_2 equivalent.

The agricultural industry and developed countries have managed to reinterpret the original concept of climate-smart agriculture, developed by the Food and Agriculture Organization of the United Nations (FAO). When the FAO introduced the approach in 2010, it was about a variety of – mostly sustainable – agriculture and forestry measures for adapting to climate change and preventing emissions. Thanks to intense lobbying, the massive use of fertilizers and herbicides as well as genetically engineered seed and industrial meat production have been deemed "climate-smart" as well – with the aim of creating new markets for fertilizers, herbicides and seed. The hijacked label has thus long since been applied to non-sustainable practices.

Climate effects: Specific details of how much CO_2 climate-smart agriculture could store are not available, as the concept is too arbitrary for reliable conclusions to be drawn. Furthermore, the CO_2 content of soils varies. Soils are by no means suitable for offsetting emissions from the burning of fossil fuels. Furthermore, the energy-intensive use of fertilizers, pesticides and fossil-fueled machinery, as well as the long transportation distances on the global market all contribute to agriculture's carbon emissions.

Ecological impact: Monocultures and the heavy application of fertilizers and pesticides to them is not only a serious burden on soils and groundwater and a threat to biodiversity – for example to vital pollinators such as bees. Industrial agriculture also leads to the destruction of humus and soil organisms; the soils become compacted and more vulnerable to erosion by wind and water.

Social impact: Instead of saving their own seed – a centuries-old tradition – farmers are dependent on fertilizer, herbicides and patented seed. This reduces their self-determination, lessens their flexibility in adapting to climate change and increases their dependence on major corporations that dominate the global market and reap huge profits.

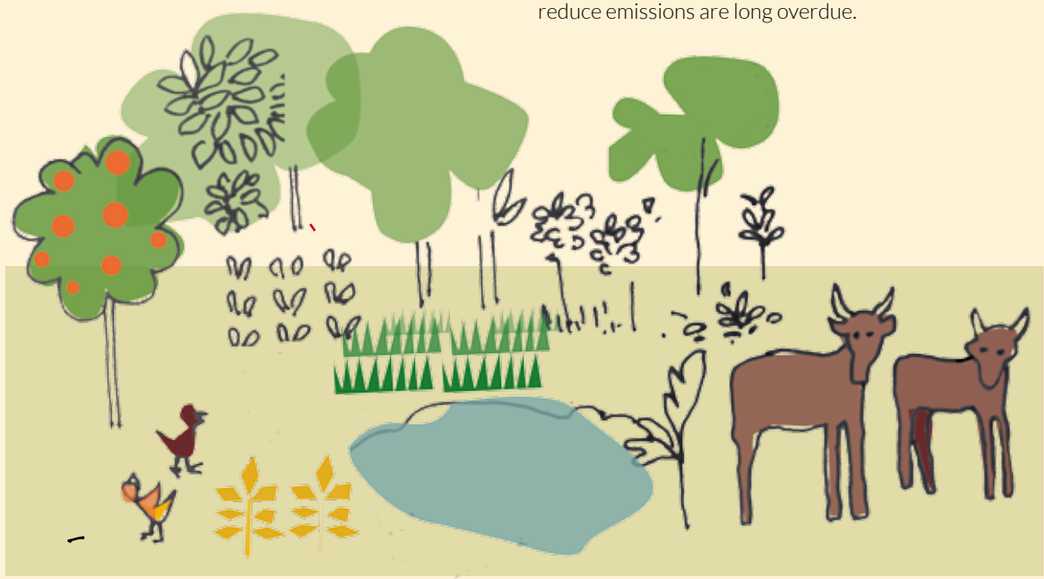


Combining agriculture and climate protection

Only good, intact soils are ideal carbon sinks. Worldwide, 10 percent of manmade emissions could be stored in such soils. Farmers have long known how to till the soil so that it stores more carbon: with sustainable and locally adapted land use and the farming practices of agricultural ecology. Carbon storage potential is increased if the crops cover the soil completely or it is protected by mulch or harvest residues. The soil then does not dry out so quickly and the soil life is more vital. Changing cultivation cycles, regular fallow periods and the use of compost and green manure are also important. These measures also help reactivate the agricultural nutrient cycles, as soil carbon aids in storing soil particles, nutrients and water. This not only increases soil fertility, but also protects biodiversity.

Industrial agriculture is not only responsible for one-third of the world's greenhouse gases, it is also destroying the soil. Poor soils can once again become fertile, however. A new agricultural policy is needed in place of industrial agriculture with its high consumption of artificial fertilizers manufactured with great energy expenditure: more support for small-scale organic farming and local structures. Local, organic food production strengthens communities, ensures family farms' incomes and avoids CO_2 emissions.

The production of meat on an industrial scale places a particularly heavy burden on the climate and soils and is cruel to animals. For this reason, the number of animals that can be kept per hectare must be limited by the volume of manure and chicken droppings that can be applied in an ecologically sound manner to reduce the nutrient loads on soil and water. A tax or levy on nitrogen can mitigate the effects of excessive fertilization, as can promoting a meat-reduced diet. Clear policy guidelines on the degree to which agriculture must reduce emissions are long overdue.



REDD – the business of forest protection

Idea: Humans have been cutting down forests for thousands of years, and wood has always been a sought-after commodity. Today, deforestation is global. It is no longer solely about harvesting wood, but also about accessing valuable land – be it for cattle rearing in Brazil, growing soybeans as animal feed in Argentina or for oil palm plantations in Indonesia. But forests not only provide vital habitats for many animal and plant species, they also serve as one of the planet's most important carbon sinks. The carbon stored in trees and soil is released as CO_2 when a forest is cleared, and so forest conservation is an essential element of climate protection. REDD – which stands for Reducing Emissions from Deforestation and Forest Degradation – is an instrument that is part of the global climate agreement. Those who conserve forests are supposed to receive money as an incentive to prevent deforestation. But who owns the forest? And who owns the CO_2 stored in the trees?

Climate effects: Countries can have forest conservation credited toward their climate goals (*p. 4/5*), reducing their need to act in other areas. However, CO_2 can only be deemed "saved" or as "avoided deforestation" if plans already existed for actual deforestation. This does not contribute to an absolute reduction in emissions. Areas that have already been destroyed or are slated to be cleared are often reforested by corporations that invest in plantations and monocultures of fast-growing tree species. According to the definition of the FAO, such tree farms are considered "forests." Plantations store only a fraction of the CO_2 of a natural forest, however. Furthermore, they are farmed intensively and the wood is sold, putting it back into circulation.

Ecological impact: Tree monocultures prevent the formation of natural forests, degrade soils and destroy biodiversity. If the land thus used is owned by corporations or the state, the plots can be sold at any time – to companies that want to mine the land, for example. Its protection is not guaranteed and the forest habitat is thus reduced to its CO_2 storage function, with biodiversity losing out.

Social impact: Tropical forests in the Amazon Basin, Central Africa and Southeast Asia in particular are often jointly managed and inhabited by indigenous peoples and local communities. Many forests are being privatized or being declared state reserves for REDD, however, and in the eyes of self-proclaimed REDD "forest guardians," local people are usually just in the way. Reports of land-grabbing and expulsion for REDD projects have been coming from numerous countries. Governments that do not – or only inadequately – recognize and protect traditional land rights are accomplices in the expulsions and the "sale" of the land.

Rethink – but how?

Every year, millions of trees are felled or burned worldwide to produce goods: palm oil in sandwich spreads and skin cream, steak dinners, grilled chicken or fuel for the car – all are everyday products in which we hardly imagine the forest to be involved. Deforestation is not automatic, but is often planned in the boardrooms of multinational corporations. Forests do not disappear by accident, but because of business plans. Political actors and decision-makers selling the land – often illegally and in connection with large bribes – are also implicated. At the end of the chain, consumers are accessories to forest destruction.

Combatting causes

The exploitation and marketing of natural resources causes deforestation – rainforests are being turned into oilfields, grazing land for mass cattle rearing, soybean fields or oil palm plantations. A first step must therefore be the fight against corruption, cracking down on organized crime, and sanctioning companies and those politically responsible for the clearing of precious forest. The one-sided privatization of natural resources must be prevented as well. Only joint management by public authorities, local communities and civil society can guarantee the transparent and democratic protection of forests. Forest conservation is not just a challenge for the Global South. Europe – where most of the forest was destroyed a long time ago – also needs concepts for environmentally sound forest management. Furthermore, Europe needs policies and laws to prevent, rather than drive, deforestation worldwide. These include the reduction of environmentally harmful subsidies, an ecological turnaround in agricultural policy and a stop to Hermes guarantees for companies that are destroying tropical forests.

Globally, the protection and restoration of natural ecosystems could result in the storage of 220 to 330 gigatons of CO_2 – an important but one-time contribution that cannot be repeated as needed.

Waste incineration – a climate policy dead-end

Idea: Consumer societies produce a virtually infinite stream of waste: packaging, disposable products, industrial waste, food scraps, obsolete electronics and much more. Misguided waste disposal policies contribute significantly to the greenhouse effect – a fact that is frequently overlooked.

Biomass waste and residual waste are incinerated in waste-to-energy plants and cement factories as a climate policy solution. The energy generated from the incineration of biomass waste is declared to be "clean", carbon-neutral bioenergy. Incineration is also intended to reduce the quantity of methane – a greenhouse gas that is 21 times more potent than CO_2 – that would otherwise be emitted from landfill sites. This approach is far from being a climate-friendly, safe and resource-efficient solution, however.

Climate effects: Urgent action is needed to phase out the climate-damaging landfill disposal of waste that is still practiced in many parts of the world. However, trying to solve the problem by incinerating waste is the wrong way forward.

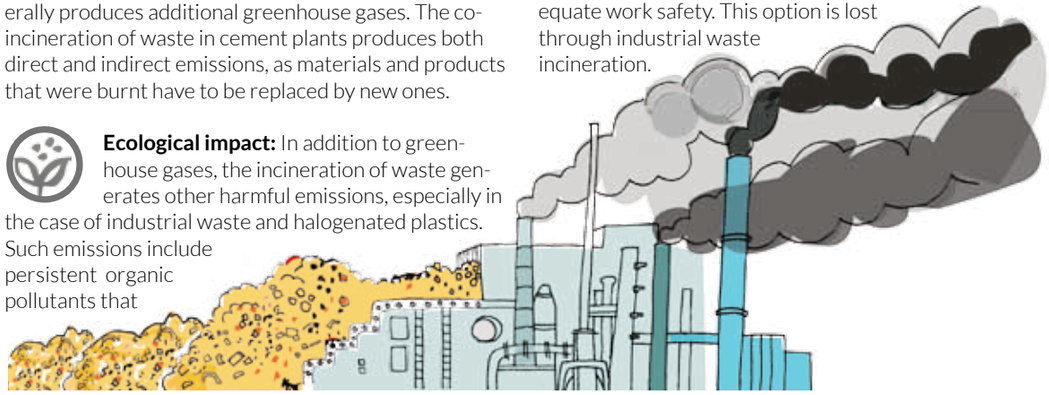
The alleged positive climate effect of waste incineration or co-incineration is insignificant: biomass waste is not a carbon-neutral fuel, as energy from biomass generally produces additional greenhouse gases. The co-incineration of waste in cement plants produces both direct and indirect emissions, as materials and products that were burnt have to be replaced by new ones.

Ecological impact: In addition to greenhouse gases, the incineration of waste generates other harmful emissions, especially in the case of industrial waste and halogenated plastics. Such emissions include persistent organic pollutants that have been banned internationally. Incineration also results in the loss of valuable raw materials that cannot be recovered from the remaining ash or slag.

The disposal and incineration of recyclable materials and waste therefore drives the continuous, worldwide extraction of new raw materials and resources. Europe, for example, already imports four times the volume of raw materials that it exports, leaving a lot to be desired in terms of international resource justice.

Social impact: Incineration of waste generates large quantities of acidic gases and other noxious byproducts that have to be rendered harmless at great expense. This is only done in a few countries, however. The incidence of cancer, skin and respiratory diseases is thus increasing in the vicinity of waste-to-energy plants and waste-incinerating cement factories – especially in countries with weak environmental legislation.

Subsidies for waste incineration provide social and economic incentives to produce more waste instead of reducing the consumption of resources in a climate-friendly manner. Waste collection and recycling offers many people an informal additional source of income, albeit often under hazardous conditions and with inadequate work safety. This option is lost through industrial waste incineration.



From a throwaway to a circular economy

Realizing a sustainable, low-carbon economy that minimizes resource consumption will require a paradigm shift that goes well beyond the waste sector: away from a linear economy in which products and packaging are thrown away and incinerated to a circular economy that does not generate waste and consumes significantly less raw material and energy.

This would require observing the following priorities: Firstly, waste must be avoided at the source, then products should be reused and repaired wherever possible, and only once that is no longer an option should they be recycled. In a circular economy, raw materials must be obtained through recycling wherever possible, not through extraction. This can also create new jobs, which – if occupational safety standards and human rights are respected – will provide sustainable livelihoods.

If the extraction of new resources cannot be avoided, mining operations must protect ecosystems and the rights of local communities.

Recycling can have a positive effect on the climate within the framework of a circular economy that relies primarily on waste avoidance. Recycling can save around 70 percent of primary raw materials compared to the new production of materials such as polyethylene film. Every kilogram of plastic that is recycled instead of being disposed of as residual waste saves 1.26 kilograms of CO_2.

The possibilities go further: Numerous examples demonstrate the feasibility and effectiveness of a transformation strategy that actually targets zero waste. In Bavaria, grassroots pressure led to the separate collection of household waste, thus reducing the amount of residual waste per capita by 58 percent between 1988 and 2014. The small Italian town of Capannori in Tuscany also committed itself to a zero-waste strategy in 2007. Today, a decade later, the city produces 40 percent less waste. More than four-fifths of municipal waste is separated and recycled directly at its source; only about one-fifth has to be disposed of as residual waste.

As early as 2010, the emission of around 160 million tons of CO_2 equivalent per year was avoided in the 27 EU countries through recycling alone. The waste targets in the European Commission's recycling concept could save an additional 190 million tons of CO_2 emissions in the EU each year – a volume corresponding to the total annual emissions of the Netherlands. Its implementation is still pending, however.

Closing remarks

The global rise in temperature is having a drastic impact on our living conditions. Heat waves, droughts, floods and hurricanes are killing and injuring people, causing severe economic damage and forcing more and more people to leave their homes. While it has long been taboo to count climate change among the causes of migration, it is now seen as one of its major drivers. Climate change has become a climate crisis.

A small window of opportunity remains in which we can avert the worst effects of climate change. Over the next ten years, we can and must drastically reduce greenhouse gas emissions.

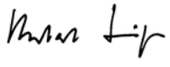
If we were to curb climate change – which would mean limiting global warming to 1.5°C above pre-industrial levels – we would also reduce one of the causes of migration. We would protect ecosystems and ensure the survival of millions of people and countless animal and plant species.

In Paris in 2015, the international community made a commitment to do whatever it takes to keep global warming significantly below 2°C. But how can this be achieved? Almost two years have passed since the historic Paris conference and the worldwide climate agreement has been in force since early November 2016 already. It is still unclear, however, what exactly must happen to drastically reduce emissions and ensure that the atmosphere's CO_2 concentration does not continue to rise. So far, this pressure to act has hardly been reflected in national policy or led to appropriate measures. Germany and Europe are no exceptions in this regard.

Many of our colleagues in civil society, as well as scientific and policy experts already anticipate that we will not stay within the limits of the emissions budget needed to keep global warming below the 1.5°C threshold. Considerable resources are thus being dedicated to research into technologies that could store the anticipated CO_2 surplus underground or otherwise remove it from the atmosphere and render it harmless. Many of these proposals have in common that they are expensive, unproven and involve high land consumption and major risks for the people and ecosystems immediately affected. They also lure us into believing that we can continue with business as usual. Reality and the new climate agreement are calling for the opposite approach, however. Initiatives and examples that point in the right direction can be found in many places.

Nevertheless, technological fixes for symptoms are currently finding a great deal of favor in the mainstream climate policy debate. Often they are seen as the only conceivable or feasible option. Yet there are numerous other emission reduction strategies that we can implement – right here and now and while respecting human rights and maintaining democratic participation: phasing out coal, expanding renewable energy, conserving forests and wetlands, applying ecological principles to agriculture and rethinking mobility. If such measures were to be implemented by the international community before 2020, enormous progress could be made in climate protection, ecosystem conservation and poverty reduction. They might even be enough to avert the most catastrophic effects of climate change. Is this a utopian belief? Hardly more so than the vague hope that we could somehow deal with the consequences of global warming by 3°C or more.

Can we succeed in bringing about the required change of course and fundamental transformation of our societies in a short time – soon enough to avert climate collapse? The first step must be to help ensure the breakthrough of real alternatives, just solutions and transformative action. With this publication, we hope to contribute toward that goal.



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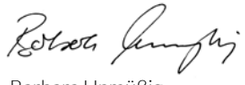

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